ONE FLOW INITIATIVE

INTRODUCTION

A major problem encountered by all users of the District Corporate Database (DBHYDRO) is the choice among multiple dbkeys (database key identification) associated with flow at a particular hydraulic structure (station). Data sets stored in some special "preferred" dbkeys have been created in DBHYDRO to generate and maintain a good set of continuous data from different sources (internal and external). However, preferred dbkeys are only limited to specific mandated sites and are updated every three months.

As improvements in technology have made it simpler for users to access the corporate database, there is an urgent need for generating a single flow record at each station for historical as well as for current flow data.

The "One Flow Initiative" is a three-phase project, under which a new automated concept has been developed, tested and is being implemented for providing a single record of flow data at a station to users. Through this project, measured field parameters are ranked and used as the basis for flow combination, one flow computation, and automation.

Phase I of the project (Concept & Prototype Development), initiated in October 2001, has been finalized in March 2002. Phase II (April to December 2002) included performance tuning, GUI (Graphical User Interface) development, and implementation into the development environment. Phase III (January 2003 to June 2004) of the project deals with integration, automation and implementation in the production environment.

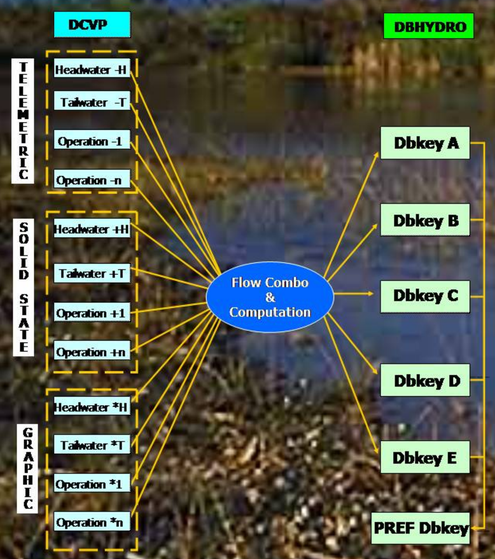
THE CHALLENGES

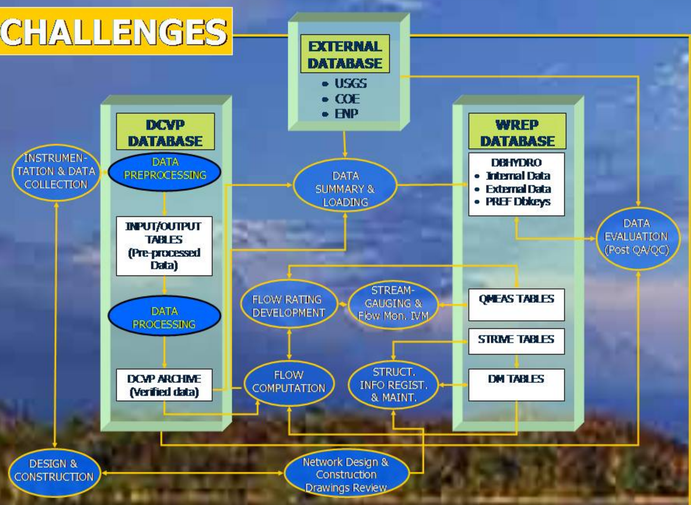
DATA FLOW PROCESS

After undergoing some extensive validation and verification procedures using tabular and graphical analysis, raw data (breakpoint data) collected from the field for every hydraulic parameter (stage, gate opening, pump speed) are identified (station id) and loaded into DCVP (Data Collection and Validation Process) archive database. Summarized data are made available for retrieval and reporting in the WREP database (or DBHYDRO) through a loading process.

SENSOR DIVERSITY

Through the years, new technologies were made available for data collection. In a constant effort for improving the process, different sensors and combination of sensors have been in use in the District for gathering data from a variety of sources including manual observations (manual), graphic strip charts (graphic), solid state data loggers (solid state) and microwave telemetry (telemetry).





FLOW GENERATION

Flow data at District hydraulic structures are generated using a flow-computation program called FLOW. Prior to the flow computation process, a preset combination of parameters (headwater and tailwater stages, structure operations: gate opening, pump speed) is required. This combination (flow combo) specifies how dynamic and static parameters (structure dimensions, control elevations) will be used to compute flow. Summary data are assigned and stored into a specific dbkey in DBHYDRO using the information stored in the flow combination.

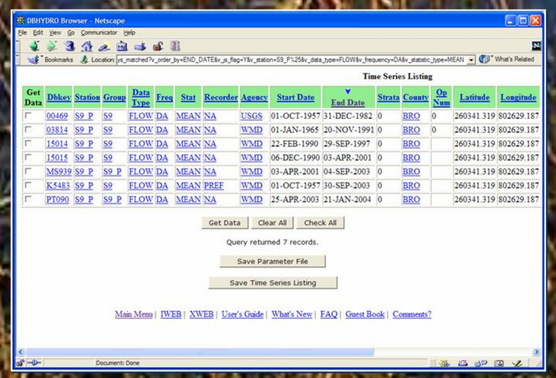
Flow computation can be performed as many times as flow combinations are possible and as long as breakpoint data are available. As a result, multiple flow dbkeys can be generated at a single site for computing flow at the same time or for different time intervals.

PREFERRED DATA SET GENERATION

To account for the multiplicity of flow data records and dbkeys generated at a station, special dbkeys called *preferred (PREF) dbkeys* have been created and manually maintained in DBHYDRO. A preferred dbkey is generated by assembling different time series data allocated in source dbkeys into one continuous set of data for a particular hydraulic structure. The time series undergoes a QA/QC procedure where breakpoint and summarized data are analyzed for quality purposes. During this process, the best data are assembled to create the preferred dbkey.

However, preferred dbkeys are limited to sites for which there are specific mandates. Preferred dbkeys may also be subject to changes when the source dbkeys change significantly (datum adjustments, flow rating improvements, software changes, structure reconfiguration, or data processing errors). In such cases, the whole process for generating the preferred key would need to be repeated, since it is not an automated process.

A QUERY IN DBHYDRO FOR S9 PUMP



MONITORING NETWORK EXPANSION

With growing concerns on the health of the environment of the South Florida and the resulting construction of all the Stormwater Treatment Areas (STAs), the District's environmental monitoring network has been rapidly expanding, and will probably keep expanding with the addition of the Comprehensive Everglades Restoration Plan, CERP. It is expected that by year 2010 the number of active flow stations will increase from 428 (1999) to 530. With such expansion, there will be a need for more data processing and reporting, more quality assurance and more "*preferred*" data.

FLOW DATA RETRIEVAL

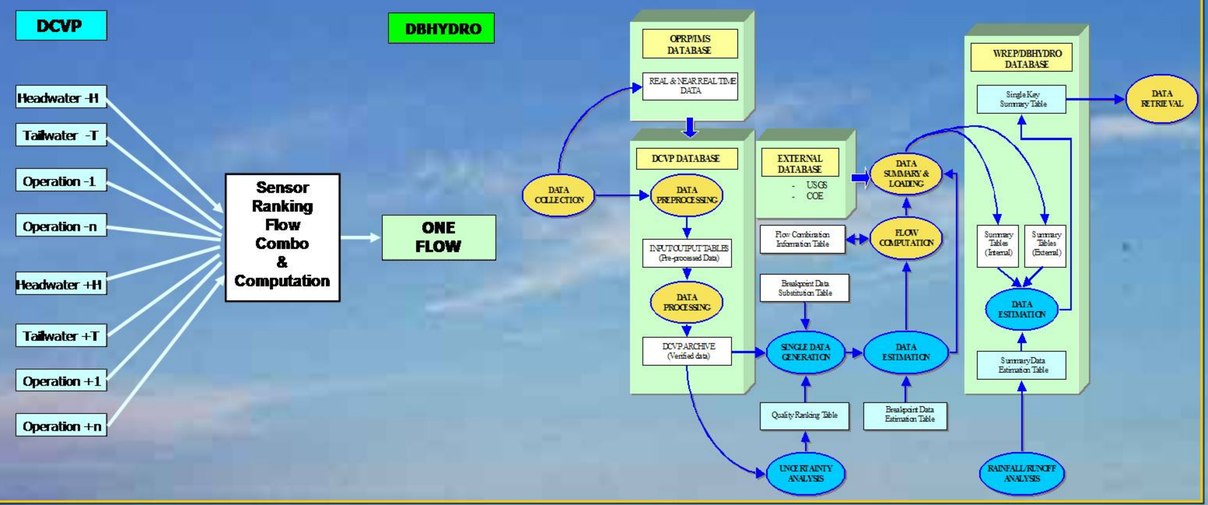
Flow data can be accessed and retrieved from the DBHYDRO database through different applications (Hydro_Prep, Hydro_Access, SQL Plus, Hydrograph, Microsoft Access, Microsoft Excel). User friendly web interfaces have been developed (DBHYDRO browser and DBIMap or Database Interaction Map) to enhance user access to the DBHYDRO database.

Although a lot of effort has been put into finding ways of improving and increasing access to and retrieval of data from the DBHYDRO database, not much has been done in terms of the uniqueness of the information to be delivered to users.

THE CONCEPT

The "one flow" concept is based on the following basic ideas: (i) uncertainty is associated with all measured values since they are subject to inherent error. Therefore, when different sensors are used on the field to measure the same parameter, choice should be based on the quality level (quality ranking) resulting from the estimation of the possible error in every measurement; (ii) all of the highest quality-ranked values can be assembled and used to generate a single flow value using the existing District flow computation program; and (iii) the resulting "one flow" may be quality rated to support decisions made by end users using the data.

ONE FLOW PROCESSES



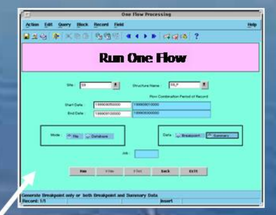
THE TOOL

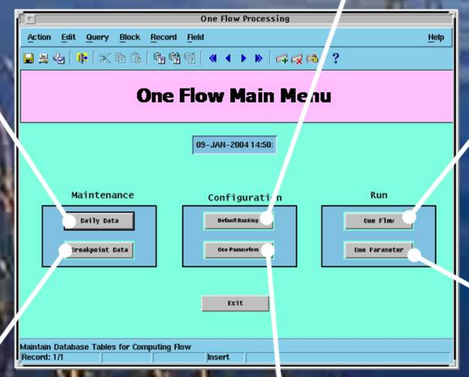
Technology

- Programming Languages: Java 1.3, PL/SQL, Oracle Form
- Design Methodology: Object Oriented
- Design Tool: JDeveloper 9i, TogetherSoft Control Center document
- Programming Tool: JDeveloper 9i
- Database: Oracle 8i
- Operating Systems: Sun Solaris, Win NT

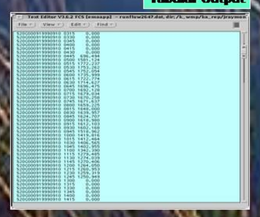
Program

- Consists of 10 sub-modules
- 18,000 lines of coding (approximately)
- 130 pages of detailed design

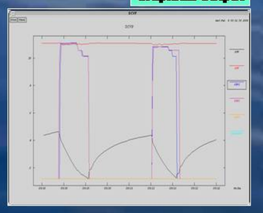


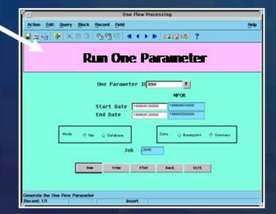


Tabular Output



Graphical Output





EMA
Good Data. Good Science. Good Decisions

Prepared for Hydrology & Hydraulics
Environmental Monitoring & Assessment Dept.
By John H. Raymond
February 24, 2004